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**ESRL Atmospheric Chemistry**  
**Patents and Industry-Related Activities**  
**2004-2007**

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Cooperative Research and Development Agreements (CRADA):

- Thermo Oriel Corporation  
Originated: October 2002  
Ended: October 2004  
For: NO<sub>2</sub> Converter Project; design/development of integrated photolytic converter  
Principal Investigator: Thomas Ryerson  
Other Personnel: Eric Williams
  
- Through a CRADA application, the technology and plans for the airborne automated 12-flask sampling system were awarded to a company in Boulder that now makes the \$10K units for the commercial market.

Small-Business Innovative Research Program (SBIR):

- Aerodyne Research, Inc. (formaldehyde instrument development)
- Current topic in competition: Aerosol dropsonde development

Patents

- Patent Pending: AirCore, for sampling trace gas profiles cheaply and in large numbers of locations on a regular basis.

Vetting of Industry-Proposed Substitutes for Ozone-Depleting Substances:

For over two decades, CSD has been the “honest broker” of information about the ozone-layer friendliness and climate friendliness of substances that industry proposes for a variety of societal uses such as refrigeration, air conditioning, electronics manufacture, and fire protection. Early information about the suitability of a proposed substance is needed by industry before costly development investments are made. Over the past 20 years, CSD has carried out laboratory and modeling evaluations of over a dozen substances and gained the reputation among industries and governments as the “go-to” laboratory for such information.

*Users and benefits*

The vetting of potential new substitutes for ozone-depleting compounds has provided cost-savings for industry and consumers worldwide. It is estimated that industry (and ultimately the consumer) is spared about \$25M per startup facility when a false start is averted by having an early picture of how ozone friendly and climate friendly a proposed new compound would be. By providing industry the earliest possible assessment of proposed new substances, the research has opened new markets, has kept the international progress to protect the ozone layer "on track," and has supported the nation's efforts in the climate arena.

### Work with Industry in the Carbon and Climate Measurements Arena:

- ESRL licensed the Multi-Filter Rotating Shadowband Radiometer to Yankee Environmental Services, Inc.
- ESRL scientists have made extensive suggestions and advice to instrumentation manufactures including: Kipp and Zonen, Eppley Labs, and Yankee Environmental Services.
- The plans and technology for the ESRL remote ground based dual-flask sampling system have been taken up by 2 companies that now produce the units for the international market.

### Work with Industry Stakeholders in the Air Quality Arena:

- I. Engagements with Stakeholders in Focused Regional Air Quality Studies:
  - Petroleum Industry (Texas, California: Exxon Mobile, Shell, Chevron)
  - Electric Utilities Industry (eastern U.S., California: American Electric Power, Electric Power Research Institute, TXU Power)
- II. Engagements with Stakeholders in NARSTO (U.S.-Canada-Mexico consortium for coordination of research on tropospheric ozone and particulate matter):
  - Conectiv
  - Constellation Energy
  - Edison Electric Institute
  - Exelon Corporation
  - First Energy Corporation
  - New York State Electric & Gas Corp.
  - Northeast Utilities Service Company
  - Northern Indiana Public Service
  - American Petroleum Institute
  - Dunn-Edwards Corporation
  - E.I. Dupont de Nemours & Company

- Eastman Kodak
- Electric Power Research Institute (EPRI)
- Ford Motor Company
- General Motors
- Instituto Mexicano del Petroleo
- Penreco
- PPL Corporation
- Public Service Enterprise Group
- Southern Company
- Xcel Energy

### Work with Industry Colleagues on National and International Assessments:

We work with many industry colleagues on several state-of-scientific-understanding assessments in both the national and international arenas. In this context, our industry colleagues serve as reviewers, coauthors, and contributors during the preparation and review of periodic assessment reports.

#### I. U.S. Climate Change Science Program, Synthesis and Assessment Products (2.4):

- E.I. Dupont de Nemours & Company

#### II. World Meteorological Organization/United Nations Environment Programme Scientific Assessment of Ozone Depletion (periodic science assessments for the Montreal Protocol). Colleagues participating in the 2006 assessment report:

- Atmospheric and Environmental Research, Inc. (U.S.)
- Biospherical Instruments, Inc. (U.S.)
- Caleb Management Services, Ltd. (United Kingdom)
- E.I. Dupont de Nemours & Company (U.S.)
- Ecofys (Netherlands)
- Ford Motor Company (U.S.)
- Hughes Associates, Inc. (U.S.)
- M&D Consulting (United Kingdom)
- NorthWest Research Associates, Inc. (U.S.)
- Ptersa Environmental Consultants (South Africa)
- Science Applications International Corporation (U.S.)
- Science Systems and Applications, Inc. (U.S.)
- The Boeing Company (U.S.)

#### III. Intergovernmental Panel on Climate Change periodic climate assessments – industry colleagues participating in the 2007 assessment report and the 2005 special report (Countries are indicated where information was available; blanks indicate unknown nationality):

- 3M (U.S.)

- AEA Technology (United Kingdom)
- A-Gas International (Australia)
- Air Conditioning and Refrigeration Institute (U.S.)
- Alliance for Responsible Atmospheric Policy
- Alliance for the Polyurethanes Industry
- American Petroleum Institute (U.S.)
- American Standard Companies (U.S.)
- Arkema Group (US, France, U.K.)
- Association of Home Appliance Manufacturers
- AstraZeneca R&D Charnwood (United Kingdom)
- Atlantic Consulting
- AVANTEC (France)
- Axima Refrigeration (Germany)
- Bayer Material Science AG
- Boehringer Ingelheim
- Boeing Company (U.S.)
- British Airways (U.K.)
- Caleb Management Services, LTD. (United Kingdom)
- Calor Gas (United Kingdom)
- Cambridge Refrigeration Technology
- Carrier Corporation (U.S.)
- Cartmell Consulting
- Consumer Specialty Products Association (U.S.)
- DAIKIN Industries (Japan)
- DaimlerChrysler AG (Germany)
- De'Longhi S.p.A.
- Delphi Corporation (U.S.)
- Delphi Harrison Thermal Systems (U.S.)
- Desert Research Institute (U.S.)
- Dow Chemical Company (US, Canada)
- Dow Deutschland GmbH & Co., Germany
- DuPont Fluoroproducts (U.S.)
- Ecofys (Germany)
- EG&G Technical Services, Inc. (U.S.)
- Electric Power Research Institute (U.S.)
- Environmental Defense (U.S.)
- ESU-Services
- European Aerosol Federation
- European Federation of Allergy and Airways Diseases Patient Associations
- ExxonMobile Research and Engineering Company (U.S.)
- Falcon Safety Products (U.S.)
- Ford Motor Company (U.S.)
- GE Consumer Products (U.S.)

- General Motors Corporation
- Global Cooling BV
- Great Lakes Chemical Corporation (United Kingdom)
- Greenhill Technology Association Inc.
- Greenpeace International
- Halon Alternatives Research Corporation
- Heliophysics, Inc. (U.S.)
- Honeywell Chemicals, Belgium
- Honeywell Fluorine Products Europe (Netherlands)
- Honeywell International
- Hughes and Associates (U.S.)
- ICF Consulting, Inc.
- INEOS Fluor
- Intercontinental Chemical Corporation (U.S.)
- International Institute of Refrigeration
- International Petroleum Industry Environmental Conservation Association and L.S. Bernstein & Associates, LLC
- International Pharmaceutical Aerosol Consortium
- ISOPA, European Isocyanate Producers (United Kingdom)
- Japan Refrigeration and Air Conditioning Industry Association (Japan)
- Linde Kältetechnik GmbH
- Marbury Technical Consulting (United Kingdom)
- Multibras SA Eletrodomesticos (Brazil)
- NorthWest Research Associates, Inc. (U.S.)
- Obrist Engineering GmbH (Austria)
- Oriel Therapeutics (U.S.)
- Otsuka Pharmaceutical Co. Ltd.
- RAPP Inc. (U.S.)
- RD Scientific (United Kingdom)
- Refrigerant Reclaim Australia (Australia)
- Remote Sensing Systems (U.S.)
- RWJ Consulting (U.S.)
- Science Systems & Applications, Inc. (U.S.)
- Siemens (Germany)
- Solvay Fluor GmbH
- Solvay Solexis
- Spray Quimica (Venezuela)
- Star Refrigeration Ltd.
- Unilever
- Valeo Climate Control (France)
- Wickham Associates (U.S.)
- Wythenshawe Hospital (United Kingdom)
- York International